

# Multi-Role Armament & Ammunition System ATD

## GDAS Program Scope and Approach



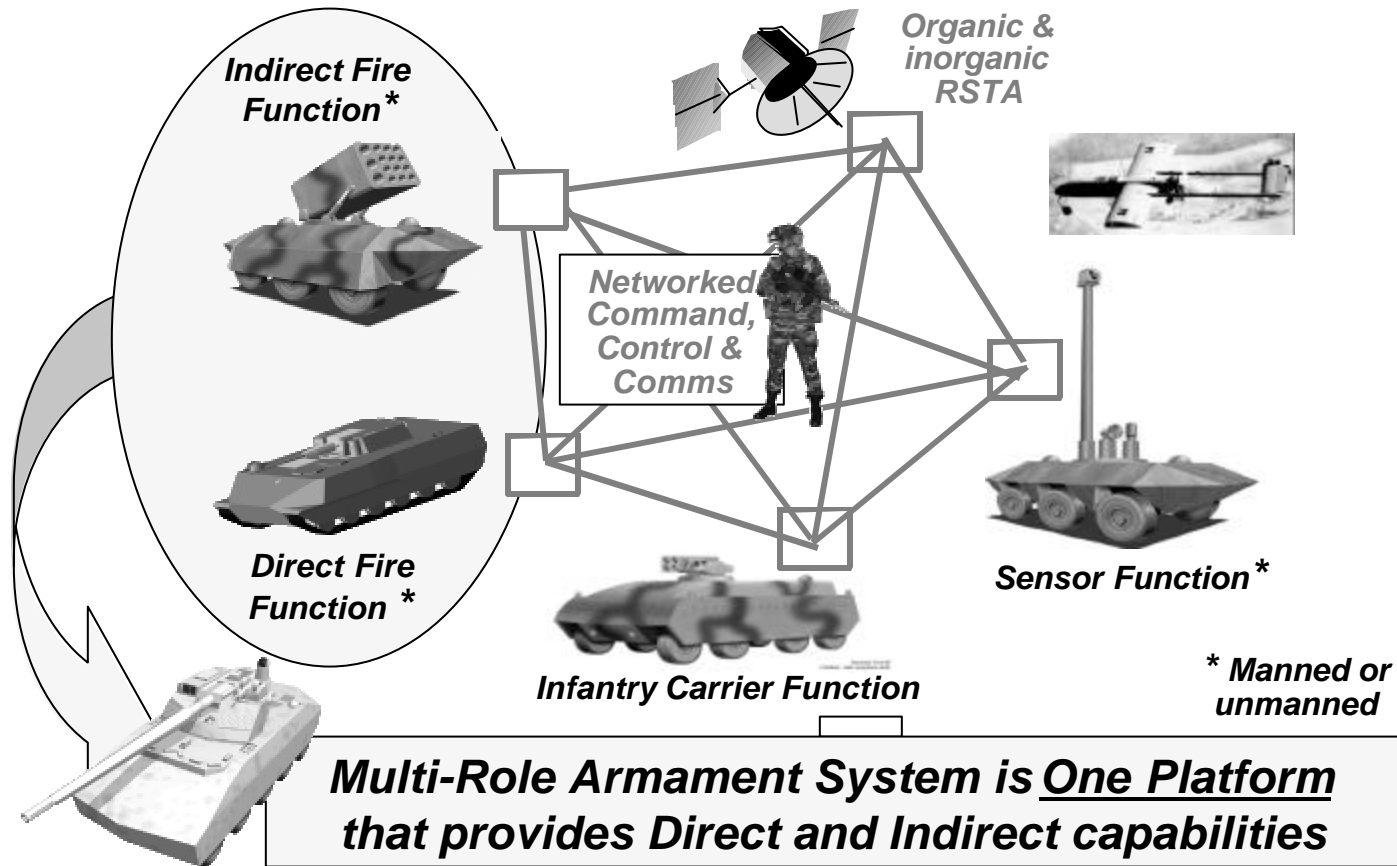
**NDIA 36th Guns & Ammunition  
Symposium April 9 - 12, 2001**

**Dr. Neale Messina**  
**Director-Systems Management**  
General Dynamics Armament Systems/  
Princeton Combustion Research Labs



**GENERAL DYNAMICS**  
Armament Systems

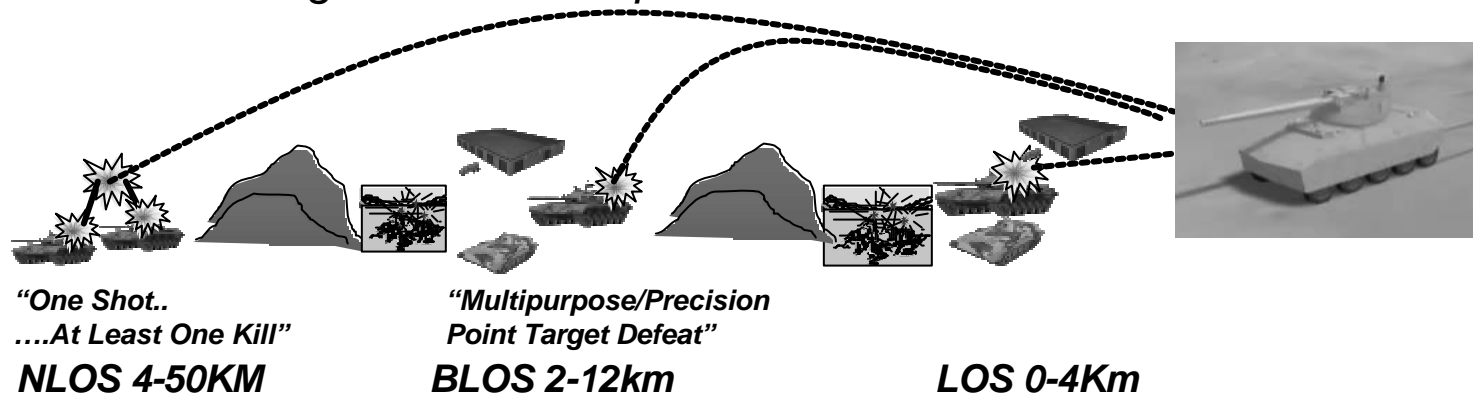
# Future Combat Systems Enabling the Objective Force



# ARDEC STO - Multi-Role Armament & Ammunition Suite (MRAAS) ATD

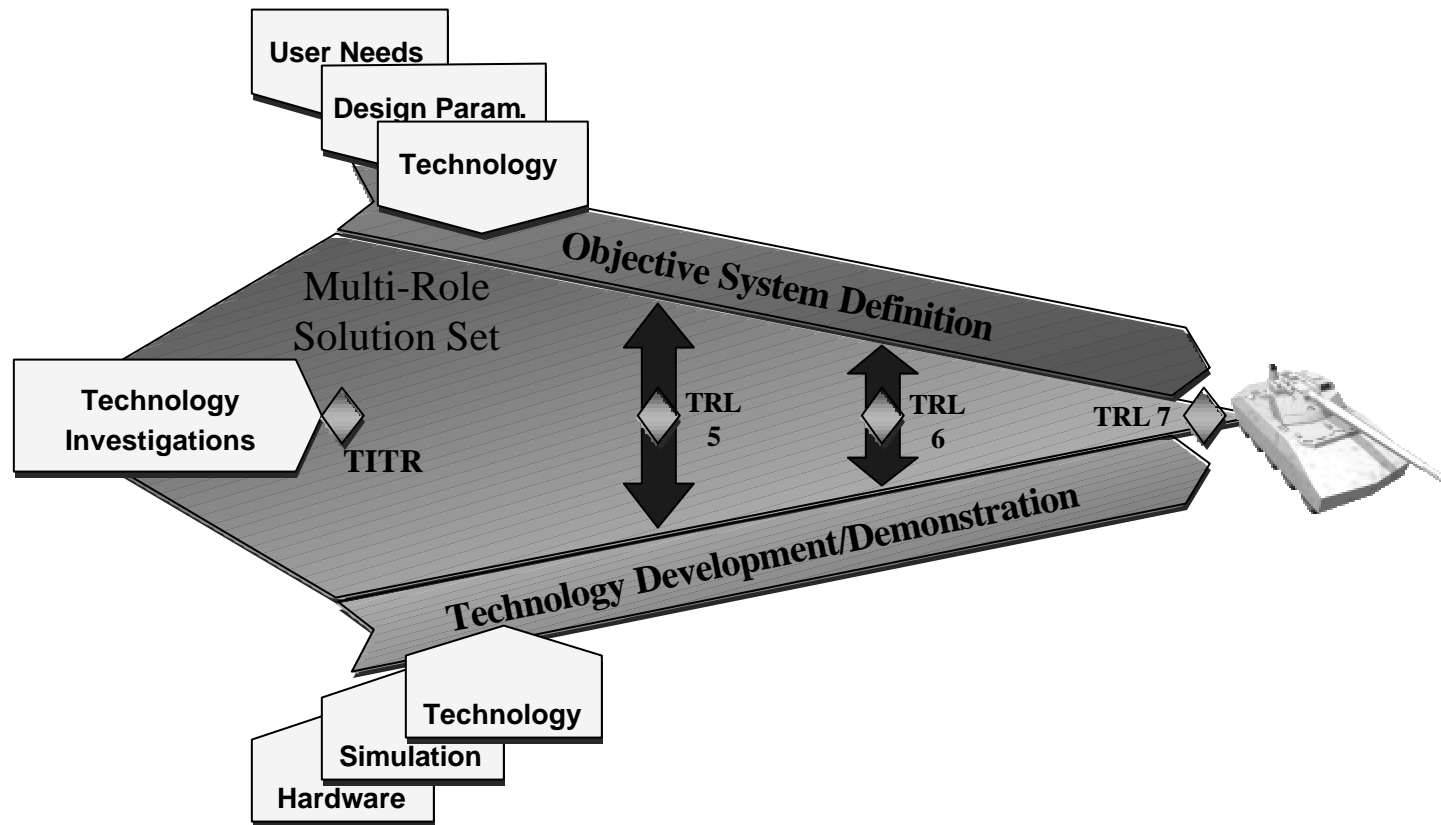
## ***ATD Objective:***

*Demonstrate an integrated multi-role armament system providing lethality overmatch capability in the expanded "Red Zone" Close Fight and Tactical Deep Fight, enabling the Objective Force to dominate maneuver throughout the Full Spectrum of Conflict.*

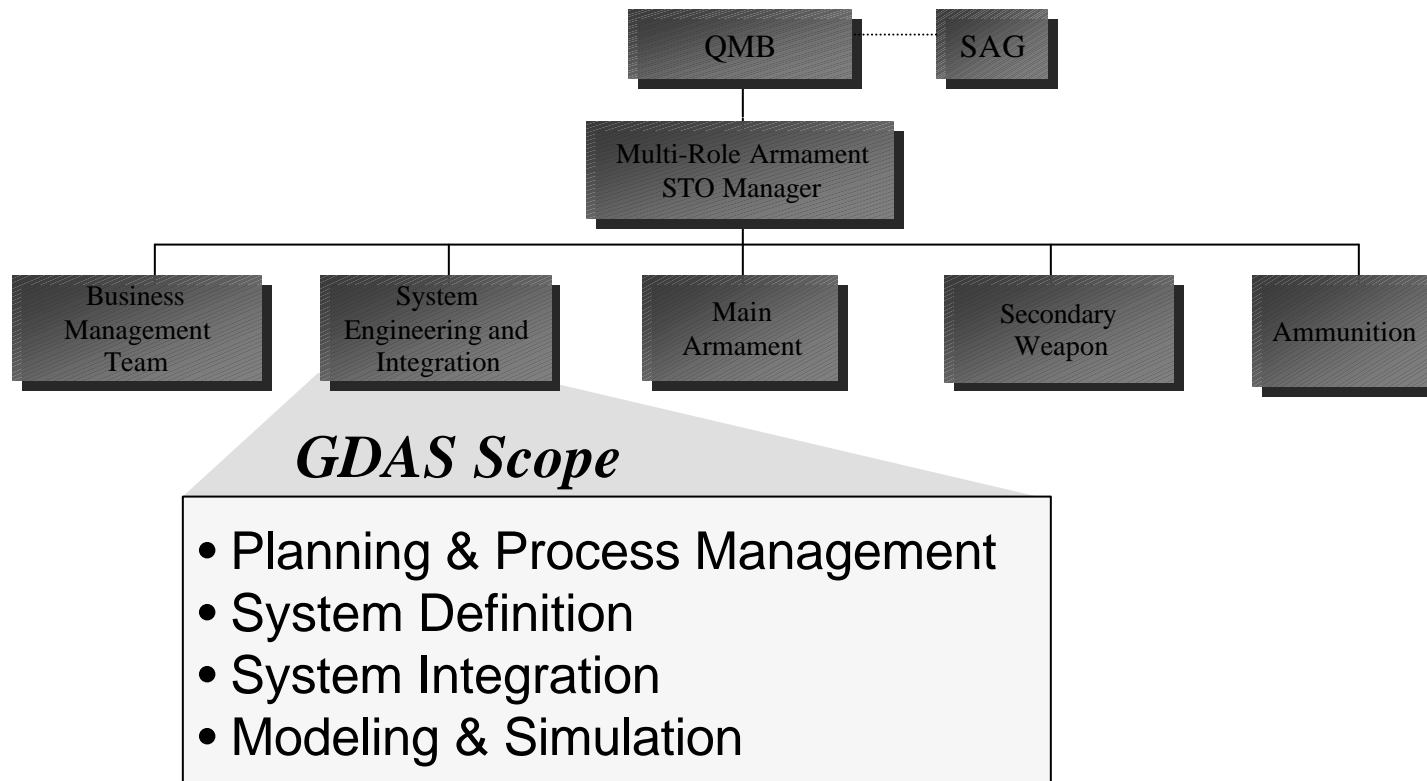


- Full-Spectrum Lethality with One Arm't Mission Module
- Maximizes Maneuver and Fire Support Capabilities
- High Stowed Kill Capacity
- Simplified Armament System & Munition Logistics
- Multi-Role, Multi-Mission Munition Family
- Multi-purpose Warhead Development
- Advanced Explosives Development
- Deliver 3 Cartridges for DARPA Demonstration

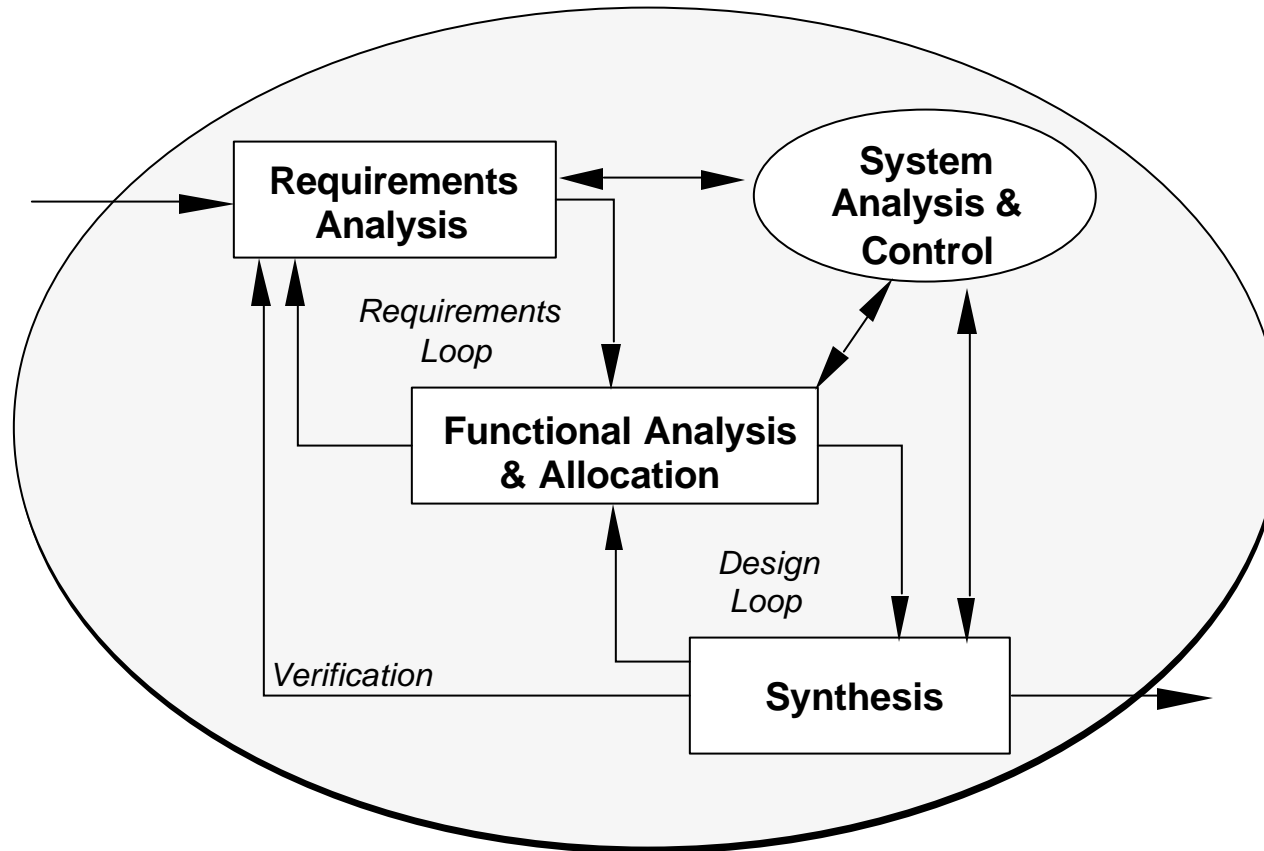
# MRAAS Program Approach



# MRAAS ATD Organization



# Systems Engineering & Integration Approach



# GDAS Program Scope

# System Analysis & Control

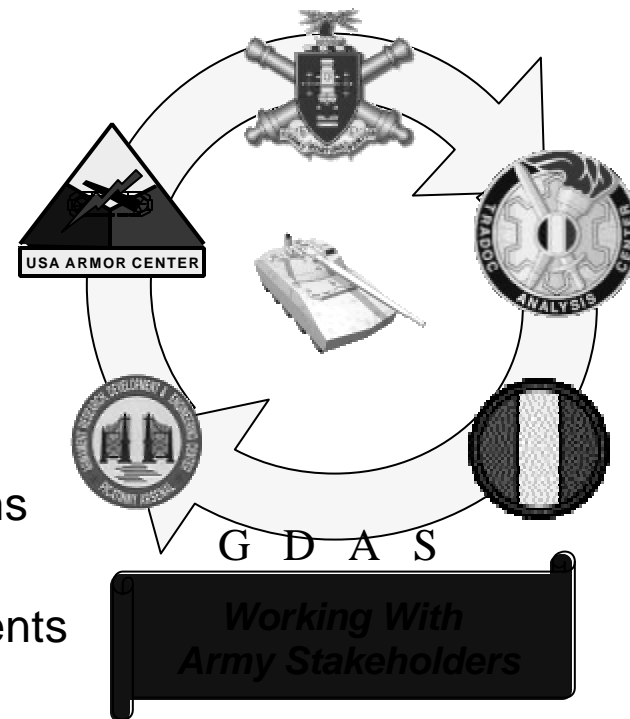
- | Systems Engineering Management Plan
- | Technology Implementation Plan
- | Trade Study Plan
- | Test & Evaluation Master Plan
- | Data Management Plan
- | Configuration Management Plan
- | CAIV Management Plan
- | Risk Management
- | Requirements Management

REF	Requirement	Category	Priority	Ref Matrix
Cd-1	Area as tactical intelligence sensor platform that recognizes intelligent adversaries, procedures, environments	Area of Interest Platform		119-118
Cd-2	Area platform is reconfigurable from the C2 vehicle or operated inside and on the move	Remotely controlled (remotely)		119-120
Cd-4	Provide command and control functions to the force while on the move	Command & Control		120-121
Cd-5	Provide command and control functions to accommodate multiple functions and layers			122-124
Cd-6	Provide information awareness	7	Constraint	131
Cd-7	Provide situational awareness	Situational Awareness		142-143
Cd-8	Provide the best tactical engagement to act decisively within the enemy's action cycle	Autonomous Action Fusion		144-145
Cd-9	Provide awareness tactical network of information throughout the Force		Boundary/Interface Issue	143
Cd-10	Provide sensor fusion and intelligence internally with the centralized digital architecture as well as legacy, joint, and coalition sources			152-156
Cd-12	Provide end-to-end of threat information		Constraint	151-161
	Systems active and passive communications capabilities to protect the FCS joint war use of the electromagnetic spectrum	Communications, Active Communications, Passive Communications		
cd-1	Security			
cd-1	Communications/Information			
		Information Environment, MDC		137-138
		Communications, Data & Information, Intelligence, and Information (C2)		139-140
		Contributory to sub-37		163-165
		Boundary		165-169
				169-172
				172-173
		Boundary?		174-176
		Boundary, Interface		174-176
				116-117
				128-142
				160-163
		MDC/MDS		163-165

# GDAS Program Scope

## Requirements Analysis

- | Elicit and Integrate User Needs
- | Develop Operational & Organizational Concept
- | Establish analytical basis for requirements (Studies)
- | Perform Functional Analysis
- | Generate Function Block Diagrams
- | Specify Performance, Interface, Design and Constraint Requirements





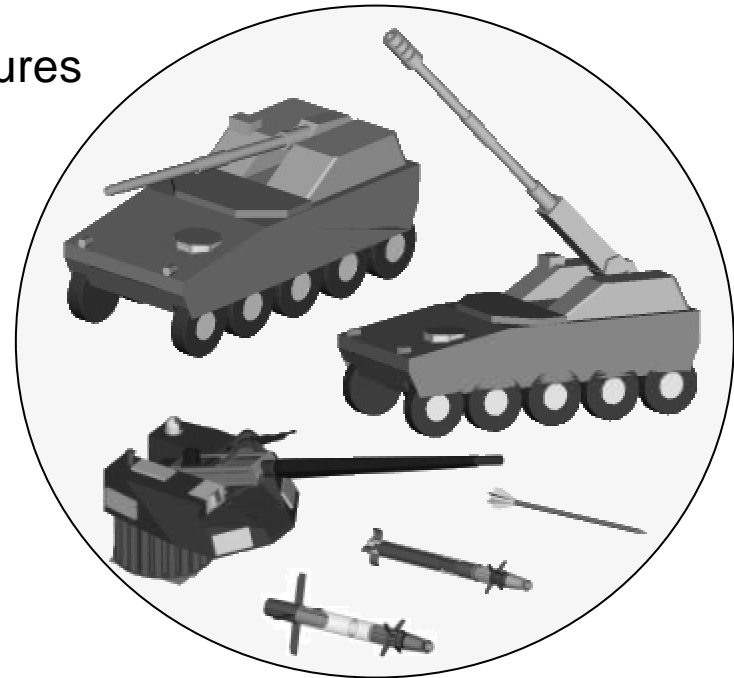
# GDAS Program Scope

## Synthesis

- | Conceptual “Strawman” Architectures
- | Functional Allocation to Elements
- | Trade-off Notional Configurations Against Explicit Criteria
- | Baseline System Architecture

## System Integration

- | Integrate Technologies
- | Identify & Control Interfaces



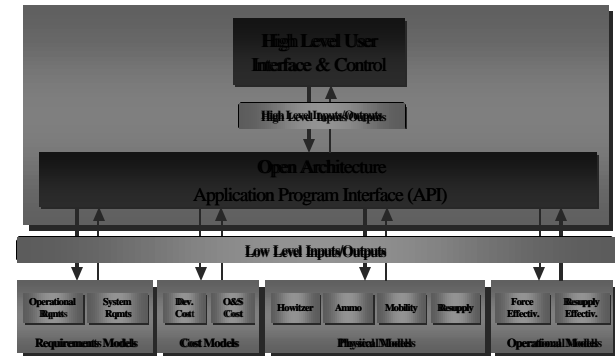
# GDAS Program Scope

## Modeling & Simulation

- | Overarching Modeling, Simulation & Analysis Study Plan
- | Force Effectiveness Study Planning & Support
- | Resupply Logistics Effectiveness
- | Integrated Virtual Product Modeling & Optimization
- | Parametric Cost Analysis

## System Level Testing

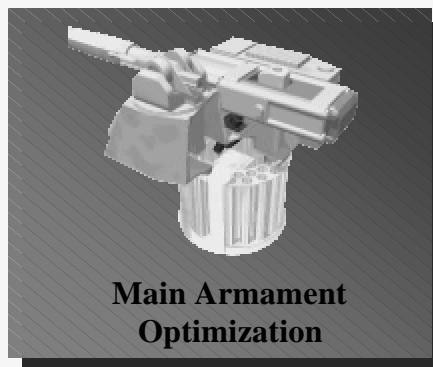
- | Test & Evaluation Planning
- | Model Validation Tests



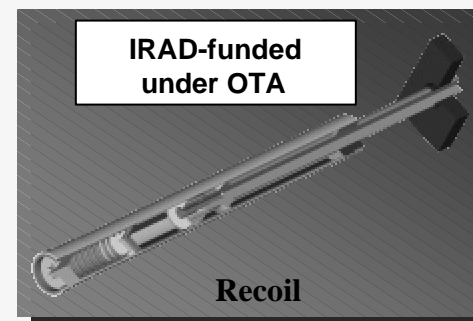
# GDAS Capabilities For MRAAS



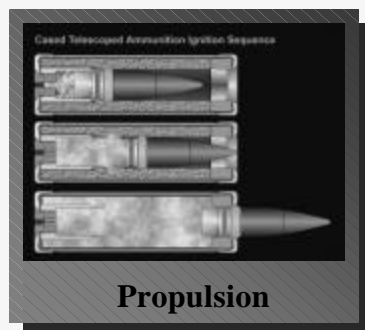
**Fire Control**



**Main Armament  
Optimization**



**Recoil**



**Propulsion**



**Automated Ammunition  
Handling**

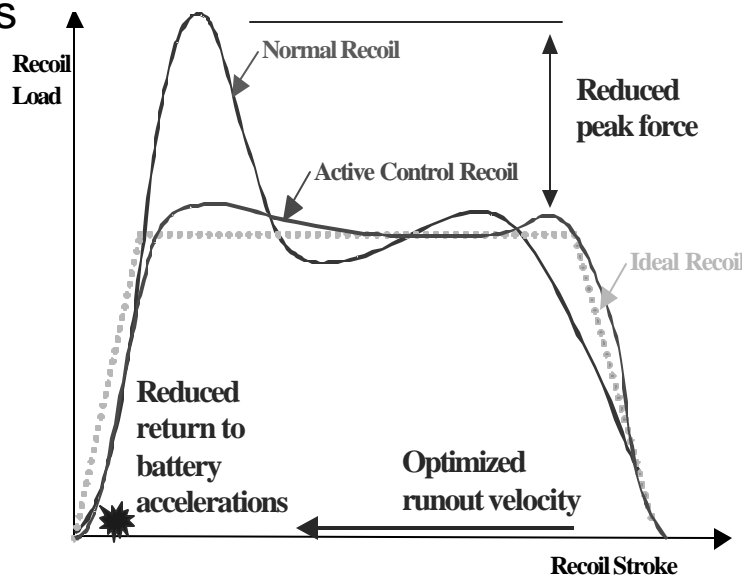


**Secondary Armament**

# GDAS Active Recoil IR&D Project

## Benefits of Active Recoil Control

- | Minimize peak recoil force
- | Reduce weight and size
- | Compensate for thermal effects and charge variation
- | Enhance accuracy & system stability



# GDAS Active Recoil IR&D Project

## Magneto-rheological Fluid (MRF) Technology Advantages

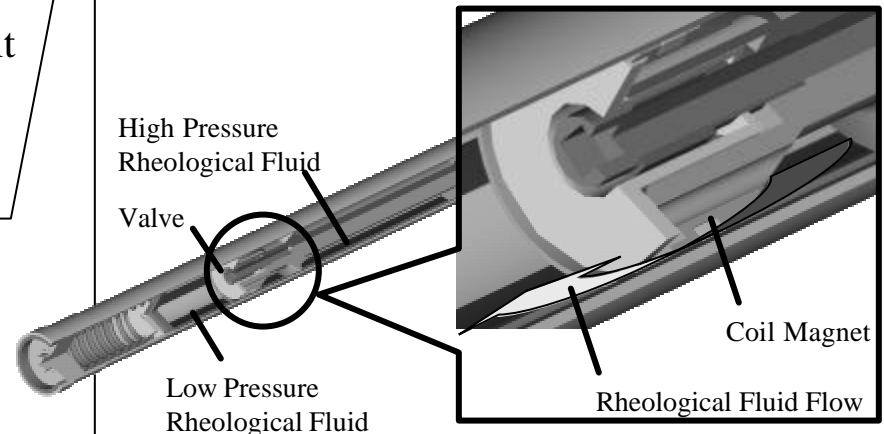
- | Recent GDAS studies indicate active recoil control with magneto-rheological fluid most promising.
- | GDAS prototype MRF control unit is scalable.

## **Final Product:**

Recoil Simulation Model &  
Brassboard Demonstrator

## Project Activity

- | Weaponization Feasibility Study
- | Concept Development
- | Prototype Design
- | Hardware Test and Evaluation
- | Demonstrate TRL 5 by April 2003



# GDAS Active Recoil IR&D Project

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## ☒ Phase 1: Feasibility

- | Assess performance requirements of MRF-controlled gun recoil system
- | Evaluate MRF technology application to gun recoil

## ☐ Phase 2: Technology Development

- | Develop gun recoil concept preliminary design
- | Develop prototype Magnetic Control Unit and Electronic Control Circuit

## ☐ Phase 3: Validation & Demonstration

- | Design, fabricate and test MRF gun recoil system